

What is claimed is:

- 1 1. A gas flow controller comprising:
2 first and second main valves connected in series and first and second servo
3 valves operated by an actuator, the opening of the first and second main valves being
4 respectively controlled via said first and second servo valves, each of the main valves
5 being operable by means of a diaphragm limiting a first gas chamber for each main
6 valve; and
7 said first servo valve being connected to said first gas chamber of the first main
8 valve via a first gas line, to a second gas chamber in the inlet area of said first main
9 valve via a second gas line and to said first gas chamber of the second main valve via a
10 third gas line.
- 1 2. A gas flow controller according to claim 1, wherein the first servo valve is
2 configured and arranged to modulate at least one of the first and second main valves
3 using the pressure in the inlet area of the first main valve and the pressure in the outlet
4 area of the second main valve as limiting pressures.
- 1 3. A gas flow controller according to claim 2, wherein at least one of said first
2 servo valve and said second servo valve includes a three-way valve means and
3 selectively connects said first gas chamber to said second gas chamber and to said outlet
4 area of the second main valve.
- 1 4. A gas flow controller according to claim 3, characterized in that said three-way
2 valve means includes at least one of: a three-way valve and a combination of two-way
3 valves.
- 1 5. A gas flow controller according to claim 1, further comprising:
2 a spring configured and arranged to load the main valve in the closed position.

- 1 6. A gas flow controller according to claim 1, wherein the main valves are
2 configured and arranged to respectively open in response to a sub-pressure in said first
3 gas chamber for each valve relative to said second gas chamber for each valve.
- 1 7. A gas flow controller according to claim 1, further comprising:
2 for at least one of said main valves, a diaphragm connected to said at least one
3 main valve and configured and arranged to substantially close said first gas chamber for
4 said at least one main valve.
- 1 8. A gas flow controller according to claim 1, wherein the cross-sectional
2 resistance and resistance of flow in the gas lines and through said servo valves are
3 configured and arranged to control at least one of: the opening and closing speed of at
4 least one of the main valves.
- 1 9. A gas flow controller according to claim 1, wherein the cross-sectional
2 resistance and resistance of flow in the gas lines and through said servo valves are
3 adjustable for modulating the opening/aperture cross-section of the main valves.
- 1 10. A gas flow controller according to claim 9, wherein the cross-sectional and flow
2 resistance of the gas lines connecting at least one of the servo valves to the second gas
3 chamber for at least one of the main valves and the corresponding inlet area of the at
4 least one servo valve are adjustable for modulating the opening cross-section of the at
5 least one main valve.
- 1 11. A gas flow controller according to claim 1, wherein said second servo valve
2 includes a three-way valve means connected to at least one of said third gas line of said
3 first servo valve and said first gas chamber of the second main valve, the three-way
4 valve means further being connected to a second gas chamber of the second main valve
5 in the inlet area and to a third gas chamber of the second main valve in the outlet area of
6 the gas flow controller.

1 12. A gas flow controller according claim 1, wherein said second servo valve
2 includes a two-way valve connected to at least one of the third gas line of said first
3 servo valve and said first gas chamber of the second main valve via a gas line on an
4 inlet side of the two-way valve and is connected to a second gas chamber of the second
5 main valve on an outlet side of the two-way valve, further comprising:
6 an outlet gas line connecting the second servo valve to a third gas chamber of the
7 second main valve in the outlet area of the gas flow controller, wherein at least one of
8 the cross-sections and resistance of flow of the gas lines from said first gas chamber of
9 the second main valve to said two-way valve and from said second gas chamber of the
10 second main valve to said two-way valve are designed differently.

1 13. A gas flow controller according to claim 12, further comprising:
2 at least one throttle in a gas line coupled to the second servo valve.

1 14. A gas flow controller according to claim 12, further comprising:
2 a pressure relief valve between the outlet gas line of said second servo valve and
3 said third gas chamber.

1 15. A gas flow controller according to claim 12, further comprising:
2 a pressure controller between the outlet gas line and said third gas chamber.

1 16. A gas flow controller according to claim 1, wherein the first servo valve includes
2 a two-way valve connected on its inlet side to at least one of the first and second gas
3 lines, wherein the cross-sections and/or resistance of flow of the gas lines from said first
4 gas chamber to said two-way valve and from said second gas chamber to said two-way
5 valve are designed differently.

1 17. A gas flow controller according to claim 16, further comprising:
2 at least one throttle in at least one of said first and second gas lines.

1 18. A gas flow controller according to claim 1, further comprising

2 a gas line connection between the first and second gas lines of said first servo
3 valve.

1 19. The gas flow controller of claim 18, wherein said gas line connection exhibits a
2 higher resistance to gas flow, relative to the resistance in at least one of the first and
3 second gas lines.

1 20. For use in a gas system including first and second main valves operable as a
2 function of movement of a diaphragm responsive to gas pressure, a gas flow controller
3 comprising:

4 a first servo valve coupled control a differential pressure across a diaphragm in
5 the first main valve for controlling the actuation of the first main valve, the first servo
6 valve further being coupled to the second main valve to selectively flow gas from the
7 first main valve to the second main valve to close the second main valve.

1 21. The gas flow controller of claim 20, wherein each of the first and second main
2 valves include inlet, outlet and auxiliary chambers, the inlet and outlet chambers of each
3 main valve being separated by a valve member, the inlet and auxiliary chambers of each
4 main valve being separated by a diaphragm coupled to the valve member of the
5 respective main valve, the outlet chamber of the first main valve being coupled to the
6 inlet chamber of the second main valve, and, for each main valve, the diaphragm being
7 adapted to actuate the valve member in response to a differential gas pressure between
8 the inlet and auxiliary chambers, wherein the first servo valve is adapted to flow gas to
9 the auxiliary chamber of the second main valve to close the second main valve.

1 22. For use in a gas system including first and second main valves, a gas flow
2 controller comprising:

3 a first servo valve arrangement coupled to a first gas chamber of the first main
4 valve, to a second gas chamber at an inlet of the first main valve and to the second main
5 valve, the first main valve being controllable in response to the first servo valve being
6 actuated, the first servo valve arrangement adapted to flow gas from the first gas

- 7 chamber to the second main valve to close the second main valve in response to the first
- 8 servo valve arrangement failing.